

O1 Tool Steel Heat Treatment Guide

Preheating, austenitizing, oil quenching and tempering for O1 cold-work tool steel, with the tempering temperatures and the hardness they leave. Reference summary of published O1 practice, not a heat treatment specification and not an Aobo Steel standard.

Reference only. Aobo Steel supplies O1 tool steel and does not provide heat treatment services. Verify the values below against the applicable standard, the mill data sheet and the heat treater's own procedure.

O1 Tool Steel Heat Treatment Temperature Chart

Heat Treatment Process	Temperature °F	Temperature °C	Practical Instruction
Stress relieving	1200-1250°F	649-677°C	Soak 1-2 hours per inch of thickness. Cool slowly. Used after heavy machining and before hardening.
Annealing	1350-1450°F	730-788°C	Soak thoroughly. Furnace cool slowly to about 900-1000°F / 482-540°C, then air cool.
Preheating	About 1200°F	About 650°C	Hold 10-15 minutes or until uniformly heated. Do not over-soak.
Austenitizing/hardening	1450-1500°F	788-816°C	Heat from preheat to hardening temperature. Avoid overheating and excessive soak time.
Oil quenching	Remove at 125-200°F	52-93°C	Quench in warm, agitated oil. Temper immediately after quenching.
Tempering	300-600°F normally	149-316°C normally	Hold about 2 hours per inch of section thickness. Select temperature according to final hardness.

Data source, the Aobo Steel O1 Tool Steel Heat Treatment Guide.

O1 Tool Steel Tempering Chart

Tempering Temperature °F	Tempering Temperature °C	Expected Hardness HRC
As quenched	As quenched	64-65 HRC
300°F	149°C	About 63 HRC
350°F	177°C	About 62-63 HRC
400°F	204°C	About 62 HRC
500°F	260°C	About 60 HRC
600°F	316°C	About 57 HRC
700°F	371°C	About 53 HRC
800°F	427°C	About 50 HRC
900°F	482°C	About 47 HRC

O1 Tool Steel Hardness After Heat Treatment

Heat Treatment Condition	Typical Hardness
As quenched, before tempering	64-65 HRC
Tempered at 300°F / 149°C	About 63 HRC
Tempered at 350°F / 177°C	About 62-63 HRC
Tempered at 500°F / 260°C	About 60 HRC
Tempered at 600°F / 316°C	About 57 HRC

O1 Heat Treatment Size Change and Distortion Control

Heat Treatment Factor	Possible Result	Control Method
Uneven heating before austenitizing	Temperature difference between surface and core	Use proper preheating before hardening
Excessive austenitizing temperature	Less predictable dimensional change	Stay within the recommended hardening range
Excessive soaking time	Increased dimensional instability	Soak only long enough for uniform heating
Uneven oil cooling	Warping, bending, or local hardness variation	Use warm, properly agitated quench oil
Improper tempering temperature	Hardness and size change outside target range	Select tempering temperature according to required hardness

Data source, the Aobo Steel O1 Tool Steel Heat Treatment Guide.

Common O1 Tool Steel Heat Treatment Problems

Problem	Cause	Result	Prevention
Quench cracking	Sharp corners, high stress, delayed tempering	Cracks during or after quenching	Improve design, stress relieve, temper immediately
Decarburization	Heating in oxidizing atmosphere	Soft surface after hardening	Use vacuum, protective atmosphere, salt bath, or surface protection
Low hardness	Underheating, weak quench, overheating, retained austenite	Tool does not reach target hardness	Control austenitizing temperature and quench conditions
Soft spots	Poor oil agitation, vapor blanket, surface scale	Local non-uniform hardness	Clean the part and use agitated oil
Excessive distortion	Machining stress, uneven sections, poor quench control	Warping or bending	Stress relieve, preheat, improve tool geometry
Over-tempering	Tempering too hot or grinding burn	Hardness loss	Control tempering and grinding temperature
Under-tempering	Too low temperature or insufficient soak	Brittleness and early cracking	Temper immediately and soak long enough

O1 Tool Steel Heat Treatment for Cold-Work Tooling Applications

Tooling Requirement	Heat Treatment Focus
Cutting edge retention	Use lower tempering temperature to keep high hardness
Punching and blanking	Balance hardness with toughness to reduce chipping
Gauges and precision tools	Control size change and distortion
Heavily machined tools	Stress relieve before hardening
Complex tool geometry	Reduce stress concentration and quench cracking risk

Aobo Steel, tool steel supplier

Aobo Steel supplies forged tool steel and stainless steel from Huangshi, Hubei, China, where the local supply chain covers ESR melting, vacuum degassing and LF refining, forging, hot rolling, turned and peeled bar, heat treatment and third party inspection. We have worked in tool steel since 2003 and supply to order in cold work grades such as D2, D3 and O1, hot work grades such as H10 and H13, and stainless grades 420, 440C and 4Cr13. O1 is supplied annealed, in round bar and flat bar, with mill test certificates to EN 10204 3.1. Reference data compiled from published O1 tool steel heat treatment sources and the Aobo Steel O1 Tool Steel Heat Treatment Guide.

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